

MISCELLANEOUS NOTES ON AUSTRALIAN DIPTERA. VII.

ON BODY-COLOUR; AND ON SPECIES OF TABANIDAE, CYRTIDAE AND ASILOIDEA.

By G. H. HARDY.

[Read 30th October, 1940.]

A theory of body coloration.—Williston (1908, 43-5), discussing the vestiture found on flies, concludes: ". . . the tomentum can only correctly be used as the designation for flattened, scale-like or stubble-like, more or less recumbent hairs, which gradually merge into dust or pollen, which is so generally represented in Diptera, and upon which the determination of many species must largely depend."

This expression is responsible for clouding the issue concerning the gradual change of the vestiture from pubescence, to tomentum, to dust (herein called the pulverulent overlay), all being regarded as having a common basis. Actually I have found no point where pubescence, tomentum and the like, ever merge into the pulverulent overlay, and so conclude they have had different origins. To give a more satisfactory account of this is the purpose of the present note.

The new theory has, of course, to be based on the view that the pulverulent overlay arises directly from the surface of the cuticle and is actually part of the cuticle that has crumbled into dust instead of being in homogeneous continuity with the body wall. It is a superlayer that has developed, perhaps, from an extra development of the normal cuticle.

It is also necessary to note that, when arranged phylogenetically, some large genera show that there is a gradual merging from the normal pigmented and somewhat shining cuticle to a highly polished one, and even to iridescence, and it is upon this bare surface that first comes a slight covering that is the beginning of a pulverulent overlay. The thin transparent layer that forms the polished surface and the powdery covering both show white in the primitive state, both being without pigmentation; in transition from one to the other, it appears as if the glass-like surface crumbles to a white powder just as transparent glass would crumble to white.

It is assumed that an unpigmented layer which gives the high polish is superimposed on the normal pigmented part of the cuticle and in continuity with it. Then it is assumed that this unpigmented layer breaks down into a pulverulent overlay. It must be noted that the overlay might be developed by the failure of the layer to form a homogeneous unit with the cuticle and thus be derived directly from the body-wall. It is not yet determined which of these actually takes place—both may do so.

Development of the coloration in the cuticle depends upon the supply of materials from waste products, and there seems to be a very definite limit to coloration found in the body-wall, ranging from yellow, which is the primitive coloration, through red, green and blue, each colour separately or in combination. A red-green gives copper, and a red-blue gives purple, but there are limits to shades developed this way. The process goes on by a deepening of these pigments in the cuticle until black, the ultimate, is reached.

It is the pulverulent overlay that shows the wider development in colours and tones, the reason being obvious when one accepts the view that the overlay is developed from the surface of the cuticle. As already stated, the clear glass-like surface layer of the cuticle breaks up into a silvery-white, but if the layer be impregnated with a yellow-red pigment, then the overlay is golden, and a black pigment there would give an ashy-white. The vast array of powdery browns met with doubtless is due to mixed pigments containing red.

Comparisons made between many of these tones in the pulverulent overlay and the colour of the cuticle lying below, suggest that the views discussed are justified, so that there may be a very definite relationship between colorations as seen in the evolutionary stages of development, yellow being the most primitive pigment colour noted.

Actually these ideas arise from a close study of coloration in the Muscoidea, making it advisable to introduce certain of the genera into these notes, but the system is now being adopted for colour studies in the lower Brachycera, where the tracing of the system is not quite so obvious.

In Muscoidea, the genus *Amenia* is the most primitive of the Tachinid flies, so much so that Townsend grades it as being a member of the Calliphoridae under his artificial classification. It has all the structures of the Tachininae, with certain features of coloration that occur in common with the Dexiinae, with which it has frequently been confused. The genus retains the primitive yellow head, but the rest of the body is largely blue-green and highly polished. The polished part also has some, but very limited, silvery powdered overlay, mainly in the form of spots below which the ground colour is darker and certainly less polished.

The white pulverulent overlay is a characteristic feature of *Microtropeza*, the primitive genus of the second section in the Tachininae. In this genus there is a wider variation in colour, but there is a strong tendency to retain the yellow head. Moreover, the reddish-yellow abdomen, as well as the more normal metallic-blue, is represented in the genus. Certain forms of metallic Dexiinae also tend to retain the yellow head, thus connecting the three chief groups of Tachinid flies in a striking manner.

There is the same story represented in the Calliphoridae, for here the occurrence of yellow species conforms to phylogeny worked out on structural development. Moreover, certain genera of the Tachinidae show the parallel colour development seen within the genus *Calliphora*, and the yellow in the body colour seems to be primitive to all such groups, while white remains the primitive coloration for the pulverulent overlay. This permits certain genera to be arranged on a coloration basis, when the species are widely different in body colours and in overlay colours.

TABANIDAE.

Colour scheme.—A wide range in coloration and general appearance occurs in this family, and has been responsible for a diversity of opinions concerning generic limits. It is now generally conceded that in Australia there are only a few valid genera, several with numerous species. *Silvius*, in accordance with those species known to me, is comparatively bare in comparison with *Tabanus*, which usually has a conspicuous amount of the pulverulent overlay even when tomentum is plentiful, and the case is similar in *Scaptia*. *Pelecorrhynchus*, which is regarded as being rather primitive, exhibits a variety of coloration that emphasizes the evolutionary aspect in development and coloration of its pulverulent overlay.

In *Scaptia* there are rather shining yellow bare species like *S. concolor* Walker and *S. inflata* Walker, and the darker, more hairy *S. constans* Walker, all of which may prove to be more primitive than the metallic *S. violacea* Macq. On the other hand, the yellow species in *Tabanus* belong to the *avidus*-group which is highly specialized and probably an offshoot from a lowly organized *Tabanus* type. The more usual form of the genus has only one species regarded as somewhat primitive, namely *T. cyaneus* Wiedemann, which is bare and metallic blue.

Pelecorrhynchus, as shown by me (1933, 412), has three groups, each conforming to its colour-scheme and there is no overlapping in this respect. The *fusconiger*-group has the abdomen bare and slightly shining, black varying to deep red-black, and the pulverulent overlay is limited to the thorax. The *personatus*-group has developed the whitish overlay on both thorax and abdomen; on the thorax of two species, lines of orange-yellow have developed.

The orange coloration is consistent on the thorax of the *fulvus*-group, and also on the abdomen of the female, but on the male the abdomen conforms to those of the other two groups, as indicated in the key to species given below. Thus in coloration

the *fusciger*-group is the lowest and the *fulvus*-group the most advanced type within the genus.

Key to the Pelecorrhynchus fulvus-group.

1. Thorax above broadly orange with a central stripe of deeper tone; black laterally. Male abdomen shining black. Wings orange with an apical black blotch *fulvus* Ricardo
2. Thorax above with a pair of yellowish stripes, otherwise black 2
2. Wings with a dark central spot on costa, another towards apex, and a small one between them remote from costa. Male abdomen with broadly interrupted white bands, which are thus reduced to two spots on each segment *mirabilis* Taylor
- Wings with a dark broad mark along costa, reaching beyond centre, and a dark subapical blotch. Male abdomen entirely black and shining *distinctus* Taylor

In the absence of the female, there is a liability to confusion in distinguishing these species from *P. deuqueti* Hardy and *P. flavipennis* Ferguson, both of which have five or more black marks on the orange wing and belong to the *fusciger*-group. The male of *P. mirabilis* is distinguished from the *personatus*-group by its very small size and the three dark spots on the wing instead of at least five or none.

PELECORRHYNCHUS OLIVEI Hardy.

PROC. LINN. SOC. N.S.W., lviii, 1933, p. 413.

♀. Similar characters to those of the male; eyes widely separated.

Omitted from the original description, the above is needed to establish the allotype and paratype females which are before me.

CYRTIDAE.

ONCODES BASILIS Walker.

Walker, *Ins. Saund. Dipt.*, 1852, 203; Hardy, *Proc. Roy. Soc. Tasm.*, 1921, 78 (which see for synonymy and references given there); Brunetti, *Ann. Mag. Nat. Hist.*, (9) xviii, 1926, 599.—*O. insignis* Brunetti, *ibid.*, 601.—*O. fratellus* Brunetti, *ibid.*, 604.—*O. castaneus* Brunetti, *ibid.*, 605.—*O. victoriensis* Brunetti, *ibid.*, 605.

Synonymy.—I am indebted to Dr. B. M. Hobby, and Mr. H. Oldroyd, who have, at my request, brought together and made comparisons between the types of Westwood in the Hope Museum, Oxford, and those of Walker and Brunetti in the British Museum. The kind permission of Professor G. D. H. Carpenter enabled this to be done. The ten types are still in existence, that of *O. flavescens* White, in the British Museum, being "very badly broken" (Oldroyd); *O. nigrinervis* White, still in excellent order, is before me, and the other two types of White are in the Littler Collection at the South Australian Museum.

Of the types in England, Mr. Oldroyd writes: "It seems very probable that one species might be sufficiently variable to include all of them, though *variegatus* Brun. has a distinct thoracic pattern of which there is no trace on the others." The sketch supplied shows a colour variation not otherwise known to me, so we both agree to its retention as a separate species.

Walker's type was compared by him with a Ceylon species, not with the Australian material of which it forms a part, except in so far as he included it in his key. The key itself is obscure, containing "conspicuously characteristic species" for *variegatus* and *insignis*, the rest being "less characteristic"; his distinguishing characters break down in other respects.

For the purpose of handling varieties in colour characters, the only feature upon which the segregations rest, I have drawn up the following:

Key to species and varieties of Oncodes.

1. Thorax entirely black above, at most a little brownish at the humeral and post-alar calli *basilis* Walker. 2
- Thorax broadly brown at sides, otherwise colour characters conform best to the description of *castaneus*, except that the posterior legs are mainly black *variegatus* Brunetti

O. basilis colour varieties.

2. Abdomen well marked with yellowish-brown; usually black lateral spots, and a central area frequently limited to one or more black spots, the rest brown. Femora half black on

- typical form, varying to mainly black (*tasmanica*) and to mainly yellow (*flavescens*).
 *basilis* Walker;
darwinii Westw.; *tasmanica* Westw.; *flavescens* White; *insignis* Brun.; *castaneus* Brun.
 The yellowish-brown of the abdomen limited to a subapical band. Femora and tibiae mainly
 yellow; except on *ater* the femora are black
 *fortunni* Westw.; *ignava* Westw.; *ater* White; *fraternum* Brun.
 No brown whatever on abdomen* 3
 3. Males† none hitherto described
 Females. Femora and tibia black or mainly so, varying to brown
 *nigriventris* White; *pygmaeus* White; *victoriensis* Brun.

The characters so grade, one to the other, that I have been unable to place any of the series seen by me into more than a single species; though there are no structural characters that may aid, I feel convinced that there is a complex of species before me.

After the appearance of Brunetti's paper, Dr. I. M. Mackerras made slides of terminalia (some of which I have seen), attempting to establish specific identities in this manner, but although he took forms that appeared to be distinct, he found no differences. I have since given attention to this matter, and think that some of my material, but not likely any of the types, may show differences in the male terminalia, but the matter will have to wait for fresh material to be studied.

Recently I have added to my collection a series of specimens showing wide colour variations, all taken from a single tree in my garden at Sunnybank, and none of the males showed any differences in the terminalia. The tree itself is frequented by these flies over the autumn months every year, as also is the ground for some yards away from the tree. I seldom see these flies elsewhere in Sunnybank.

APIOCERIDAE.

Genus APIOCERA Westwood.

Lond. Edin. Phil. Mag., vi, 1835, 449—type *A. fuscicollis* Westw. = *asilica* Westw.—*Tapinocera* Macquart, *Dipt. Exot.*, suppl. 1, (2) 1838, 78—type *Laphria brevicornis* Wied.—*Pomacera* Macquart, *ibid.*, suppl. 2, 1847, 49—type *P. bigotii* Macq. = *asilica* Westw.

Synonymy.—The synonymy given above is not new, but the identities of the types are now ascertained. For the elucidation of this matter I am indebted to Dr. B. M. Hobby and to Mr. H. Oldroyd, who have made comparisons between those specimens in the Hope Collection and those in the British Museum. Mr. K. R. Norris has supplied me with specimens of *A. pallida* Norris, paratypes, which species, as he states, is not related to *A. maritima* Hardy; nevertheless, I note that the frons on the female is almost parallel sided, standing between the strongly converging frons and that normal diverging frons which seems to be a standing character for the male and all other species of *Apiocera* known, as well as those of the genus *Neorhaphimoides*, specimens of which were also received from Mr. Norris.

Before me are specimens of *A. pica* Norris (Perth, 16th November, 1912; 2 ♂, 2 ♀) which are related to *A. asilica* Westw.; judging from description, *A. tonnoiri* Norris is related to *A. imminuta*, n. sp., which I have previously (Hardy, 1933, p. 418) referred to as a coastal sand-dune species. These two cases are the closest contacts I have yet detected between the *Apiocera* species of the western and the eastern regions of Australia.

Terminalia.—On the male, the dorsal lamella is divided, the ventral lamella present, contiguous with the aedeagus and hence there is no median plate. The aedeagus is very short and has a small armature. The ninth tergite is developed to forceps; the lower forceps are developed and the claspers are hinged, frequently having strong black bristles. The ventral plate is narrow, blunt apically.

* In all living specimens there is a line-like apical margin that is white, and liable to turn yellow after death; this is not to be confused with the subapical and adjacent brown nearly always present on males.

† According to description, *O. ater* White was based on the male having the hind margin of the abdomen narrowly and indistinctly brown, but Dr. Hobby refers, in a letter, to one on which it is all black, so evidently a second specimen was identified by White at a later date and would fall to this position, agreeing with several other specimens before me.

In life the eyes are red, with a slight tinge of green reflection, and the proboscis is able to be retracted and protruded for the length of the labellum.

Key to species of Apiocera in the eastern States.

1. Brick-red species (not seen) *vulpes* Hermann
Black or brown species 2
2. Eye-summit-eye proportion on male 2:4:2 (summit 50% of total head-width); on female 5:14:5 (58%). Frons strongly converging from summit towards antennae. Colour markings absent, the ground colour being obscured completely by a whitish pulverulent overlay, or, if markings are detected, they show as narrow light apical margins on the abdominal segments. Coastal sand-dunes *maritima* Hardy
Summit much narrower, less than 40% of total head-width. Frons broadening from summit towards antennae 3
3. Eye-summit-eye proportion on male 3:1:3 (14%), and on female 11:10:11 (31%). A broad central stripe of brown on the thorax is entirely without a median white line, and the whole insect is of chocolate-brown colour with markings otherwise not unlike those of *asilica*. Antennae and proboscis reach about the same distance, and the palpi reach to the labellum *immedia*, n. sp.
Thorax with a median white line, making four dark and five whitish stripes 4
4. Eye-summit-eye proportion on male 11:6:11 (21%), on female 5:6:5 (37%). Thorax with the lateral dark stripe divided into three spots well rounded on front edge; the proboscis is short and the palpi reach the labellum *asilica* Westwood
Thorax with the lateral stripe practically complete, divided by a very thin white line that is straight and not particularly noticeable 5
5. Eye-summit-eye proportions on male 9:4:9 (18%), on female 8:7:8 (30%). Abdominal markings reduced to a pair of white spots on each segment *brevicornis* Wiedemann
Eye-summit-eye proportion on male 7:5:7 (26%), on female 5:4:5 (28%). Abdomen with a pair of white stripes complete or practically so. The palpi fail to reach the labellum of the long proboscis by nearly the length of the second segment sp.
Abdominal markings reduced to white along the posterior margin of the segments 6
6. Eye-summit-eye proportions on male 7:5:7 (26%), female unknown. Antennae placed very low on head and the proboscis and palpi are unusually short. Coastal sand dunes *imminuta*, n. sp.
Eye-summit-eye proportions on male 3:2:3 (25%), on female 5:6:5 (37%). Palpi fail to reach the labellum of the long proboscis by about the length of the second segment. Western plains *norrisi*, n. sp.

APIOCERA MARITIMA Hardy.

PROC. LINN. SOC. N.S.W., lviii, 1933, 416, fig. 1.

No bristles have been detected on the claspers of this species.

Hab.—Queensland and New South Wales. Miss K. English has submitted specimens from the latter State for identification.

APIOCERA IMMEDIA, n. sp.

Apiocera sp., Hardy, PROC. LINN. SOC. N.S.W., xlvii, 1921, 296, fig. 16.

This very distinctive species is readily distinguished by the characters given in the key. It is of a deep shining chocolate-brown colour and without the white median thoracic line recorded on *A. vulpes* Herm. and occurring on all the others given below. A pair of slender white stripes reaches the transverse suture, and may be traceable to a pair of white spots placed just before the apical margin. Laterally another pair of white stripes reaches the transverse suture, slightly interrupted at the margin of the humeral callus, followed by two pairs of white spots, one above the wing insertions, the other on the postalar callus, reaching the scutellum which is without visible marks. On the male the abdomen has a pair of white spots, overlapping insertions, at the apex of the third to sixth segments; on the female similarly marked on the first to fourth segments. Head, pleura and venter normal, as on *A. asilica*. This is the only species I have seen that has a tendency for the whitish markings to become yellow, as against the ashy-white colouring of the others. Length 24–26 mm.

Hab.—N.S.W.: Sydney, 1 ♂, 2 ♀, 26th December 1918; probably from La Perouse.

APIOCERA ASILICA Westwood.

Lond. Edin. Phil. Mag., vi, 1835, 449; *Isis*, ii, 1838, 87; *Arcana Entom.*, i, 1841, 56; Walker, *List Dipt. B. Mus.*, vi, suppl. 2, 1854, 56; Osten-Sacken, *Berl. Ent. Zeit.*, xxvii, 1883, 294.—*A. fuscicollis* Westwood, *ibid.*, 1835, 449; *ibid.*, 1838, 87; *ibid.*, 1841, 56;

Hermann, *Deut. Ent. Zeit.*, ii, 1909, 107.—*A. moerens* Westwood, *Arcana Entom.*, i, 1841, 56, Pl. 14, fig. 6; Walker, *List Dipt. B. Mus.*, i, 1848, 229; Hansen, *Fabrica oris Dipt.*, 1883, 170, Pl. 5, figs. 22–28; Hermann, *Deut. Ent. Zeit.*, ii, 1909, 107.—*Pomacera bigotii* Macquart, *Dipt. Exot.*, suppl. 2, 1847, 49, Pl. 2, fig. 1; Hermann, *ibid.*, 1909, 107.

Synonymy.—A letter from Dr. B. M. Hobby (which includes the view also accepted by Mr. H. Oldroyd) states that the types of the two first species of Westwood are in the Hope Museum, both recognized as being the types in Sir Edward Poulton's handwriting. The type of *A. moerens* is apparently lost and so specimens regarded as conspecific were used for comparison. The two types have lost nearly all their pulverulent overlay and are more or less uniform dull-black; only a remnant of the abdomen remains in *fuscicollis*. Size, shape, antennae and mouthparts, and faint tracings of markings follow closely those of *moerens*, so it is advisable to regard all three as belonging to one valid species. The only difference detected is in the lighter wing-veins on *fuscicollis*.

Hermann regarded *A. fuscicollis* and *A. moerens* as being two species, and *A. bigotii* as a possible third, but it is doubtful if he could have had any correctly named specimens; his references are included above, but he gave no descriptions enabling his species to be identified. It seems to me probable that Macquart's species was from Sydney, as the family is quite unknown from Tasmania, and Macquart's figure agrees with the present interpretation, except that the anterior half of the thorax has no proper marking, and perhaps was greasy. Williston (1908, fig. 70) gives a very good figure of the male without a specific name.

Hab.—Queensland, New South Wales and Victoria. Specimens from all these States are before me; the distribution of the species extends from the coast to the Mallee districts (Ouyen) of Victoria. The claspers were found to correspond rather well with those of *A. pica* Norris, which species has the markings rather similar.

APIOCERA BREVICORNIS Wiedemann.

Laphria brevicornis Wiedemann, *Auss. zweifl. Ins.*, ii, 1830, 646.—*Tapinocera brevicornis* Macquart, *Dipt. Exot.*, 1, ii, 1838, 79, Pl. 6, fig. 15; Walker, *List Dipt. B. Mus.*, vii, suppl. 3, 1855, 573; Schiner, *Verh. Zool. Bot. Ges. Wien*, xvi, 1866, 649.—*Apiocera brevicornis* Osten-Sacken, *Berl. Ent. Zeit.*, xxvii, 1885, 294.

As this species is said to be rather slim and has yellowish hairs on the frons, it cannot be identical with *asilica* Westw., so I attach the name to a common species that best fits the description. The claspers, with few bristles, are not unlike those of *A. minor* Norris.

Hab.—New South Wales; the specimens before me are all from the Blue Mountains, where it is common, 3 ♂, 5 ♀, January 1926.

APIOCERA sp.

I leave unnamed a Queensland species that is quite distinctive. Two Brisbane females are before me, from Sunnysbank, whilst males are in Mr. F. A. Perkins' collection from Inglewood. I am uncertain if I have the sexes allied correctly.

APIOCERA IMMINUTA, n. sp.

A. sp. Hardy, *Proc. Linn. Soc. N.S.W.*, xlvi, 1921, 296, fig. 14.

This coastal sand-dune species is known to me only from the male, and the characters given in the key are ample for the recognition of this sex. It will be noted that the summit width corresponds to that of the unnamed species, but the head is relatively much wider. The proboscis is so short that the antennae extend well beyond it, more so than shown in the figure which was drawn in perspective, and in which the antennae were placed too high, for they correspond to those of *A. tonnoiri* Norris. The median thoracic stripe is short, but the two adjacent pairs may extend unbroken to the scutellum. The apical margins of all abdominal segments are thinly bordered with white, interrupted on the three basal segments at the median line, and the lateral white stripes may extend over the four basal segments and be traceable on

others. The claspers have a dense mass of bristles almost reaching the apex. Length 15 to 18 mm.

Hab.—Queensland: Southport, 3 ♂, December 1931, one selected for the holotype. New South Wales: Sydney, 1 ♂, 1st December 1918 (probably from La Perouse), and two others, 19th January 1919.

APIOCERA NORRISI, n. sp.

The markings are as on *A. imminuta*, the head is normal and the proboscis is slightly longer than twice the head length, extending well beyond the antennae. The characters given in the key are ample for recognition of the species and, in addition, the wing has the first and second median veins weakened and white but complete, whereas the third and fourth median veins meet as usual, but do not continue, so the united part which normally runs to the wing margin is absent. Length, 12 to 13 mm.

Hab.—Queensland: Mungindi, 1 ♂, 3 ♀, all found resting on twigs at sundown, six miles north, along the Dareel road on red soil country. The species looked very much like an *Anabarrhynchus* (Therevidae) for which it was mistaken when seen in flight, earlier in the day, over the adjacent paddock infested with *Bassia Birchii* (Chenopodiaceae).

Named as a tribute to Mr. Kenneth R. Norris, whose work (1936) on the Apioceridae of Western Australia has formed a basis for these notes.

ASILIDAE.

Colour scheme.—Certain sections in this family are remarkable for their dense hairy nature, the hairs carrying colours that are excluded from this account which refers only to the cuticle colour and the pulverulent overlay. Sufficient has been worked out in a series of papers (Hardy, 1934-5) to show probable relationships between genera; when arranged in accordance with this, the coloration in the family becomes enlightening.

It is proposed here to discuss *Apiocera* with the Asilidae, the genera being arranged in accordance with the form taken by the female terminalia which gives the main guide to phylogeny.

The Phellini show that originally the ninth tergite on the female was complete and without any indication of acanthophorites. This condition presumably preceded that of *Apiocera* where a ridge is formed along the dorsal line of the ninth tergite which carries spines that turn this tergite into acanthophorites fused together. *Apiocera* also has an adaptation of its median plate that permits the protrusion of the proctiger, a feature that is found also in *Brachyrrhopalini* where the ridge is absent and the acanthophorites are separated. Other primitive genera of the Dasypogoninae have the median plate otherwise formed, allowing of no retraction of the acanthophorites and, when present, the ridge is separated from the acanthophorites, lying between them, looking almost like an extra spine inserted there. In the more advanced genera this ridge disappears and at a later stage the acanthophorites themselves tend to atrophy and ultimately to disappear, as in most genera of the Asilinae.

Coloration is parallel to this, for the primitive *Phellus* is without a pulverulent overlay and is highly metallic in body-colour; the yellow colouring is in the hairs. It has reached the metallic-blue stage only. In *Apiocera* the body-colour on one species is said to be brick-red; the genus certainly varies from brown to black, a metallic stage being absent. The pulverulent overlay is strongly ashy-white, rarely tending towards yellow, but the genus forms a side issue carrying its own peculiar features. In the *Brachyrrhopalini*, yellow, red, and black predominate in the colour pattern of the body which is normally without a marked pulverulent overlay, but one species with a red thorax has a slight pulverulent overlay there and another has a distinct pattern. Most species have a slight overlay around the face and on coxae, and this may even become yellowish.

The more generalized types of the other Dasypogonini have very little overlay, but this becomes well developed in certain genera, *Chrysopogon*, *Bathypogon* and *Metalaphria* being examples, and even certain tribes, the Stichopogonini being one. The overlay is much less marked in the Atomosiini, whilst in the Laphriini the exotic species I have

examined are without the overlay, yet, amid the Australian ones, the overlay is scanty and best developed on *Laphria tectamus* Walker, the thorax having quite a distinct pattern. Otherwise the majority of forms have reached the highly metallic stage, and although Bromley (Abst. Doctor's Dissert., No. 14, Ohio Univ., 1934, 125) regards them as being "the most recently evolved of the Asilidae", this does not apply to the colour characters.* It is in the other subfamily, the Asilinae, that the pulverulent overlay is general and well developed.

The following notes, mainly on terminalia, are additional to descriptions in my 1934-5 papers.

LAPHRIA TECTAMUS Walker.

List Dipt. Brit. Mus., ii, 1849, 374.

On the male the dorsal lamella is divided, and the ventral lamella extends well beyond the dorsal one. The proctiger is fixed well beyond the undivided ninth tergite which is thus not incised. The claspers are hinged and the lower forceps are small, but the support of the two claspers seems to be in one unit supporting them both. The aedeagus has an armature and, unless the median plate be combined with this, it is absent. It is not certain if a ventral plate occurs.

MAIRA AENEA Fab.

Syst. Antl., 1805, 161 [*Laphria*]; Ricardo, *Ins. Samoa*, vi, 1929, p. 118.

This species is recorded as from North-east Australia by Ricardo in the above reference, and a series from the same locality is in the Deutsches Entomologisches Institut, Berlin-Dahlem.

Genus BATHYPOGON Loew.

Loew, *Prog. Realsch. Meseritz*, 1851, 13.

On the male, the dorsal lamella is divided and the ventral lamella is present. The aedeagus is short and attached for the full length to a broad armature and, being united, these are hinged to swing together; as the base is contiguous to the proctiger, there is no median plate. The ninth tergite is formed into upper forceps, and the lower forceps are short and very broad. The claspers are hinged. The ventral plate is rather broad and a pair of apical spine-like processes project from it.

On the female the dorsal lamella is divided and the ventral lamella is present but membranous. The median plate is in two parts, anterior and posterior, both divided longitudinally; this form of median plate is one that is divided into four areas of chitin. The acanthophorites are present and between them the dorsal ridge lies detached. The genital groove is without chitin. A pair of plates containing supplementary spines is present, and these plates almost meet for a considerable distance along the median line, while two strong and two weak bristles lie at the outer area.

Judging from this form of the supplementary plates that bear spines, and that occur in various genera, many other genera have vestiges of them in the form of minute sclerites that have not been understood hitherto, and therefore were not specified in my account of the terminalia. In the more complete form they are present throughout the Therevidae and primitive genera like *Phellus* and *Erethropogon*, and are quite unknown to me outside the Asiloidea. Presumably they mark a primitive condition for the superfamily.

Genus STENOPOGON Loew.

Linn. Ent., ii, 1847, 453.

♀. The dorsal lamella is divided and the ventral lamella is present. The median plate is as on *Bathypogon*, as also are the plates that bear supplementary spines. These latter plates taper towards each other, ending in a point, instead of being broad along the

* Bromley cannot be correct in drawing his conclusion, for the evidence of structure indicates the origin of the tribe Laphriini may have been an ancient stock, the larvae specializing by following wood-boring beetles. The subfamilies Dasypogoninae and Laphriinae, as used by Bromley, do not mark natural divisions, the cleft originally thought to lie between these two major groups being non-existent, thus making unsatisfactory any criticism of general conclusions that may be drawn from the study of the complexes concerned.

median line. Acanthophorites and dorsal ridge are as on *Bathypogon*, and the genital groove has chitin at the base and a pair of small chitinous ridges near the apex.

RACHIOPOGON GRANTII Newman.

Trans. Ent. Soc. London, iv, 1857, 57.

On the male there are seven abdominal segments. The terminalia are bulbous and have a ventral plate. The species is the genotype and the genus is a complex as it now stands; owing to its rarity in collections, the present species is not adequately understood. The sexes are similar in general characters.

Hab.—Queensland: Brisbane. 1 ♂ taken by Mr. C. F. Ashby, near the Enoggera Reservoir, during November, 1938. As the unique type is lost, and without recorded sex, I have labelled this specimen the allotype male. Ricardo described the female, also from a unique, and this acts as a substitute for the holotype.

Genus CHRYSOPOGON Roder.

Berl. Ent. Zeit., xxv, 1881, 213.

On the male the dorsal lamella is divided and the ventral lamella is rather small. The median plate is absent and the aedeagus is simple. The ninth tergite is a simple sclerite. The lower forceps are developed and the claspers are fused to their support. The ventral plate is present.

The female terminalia show the dorsal lamella divided, and the ventral lamella rather small. The acanthophorites are large but without the spines, and the dorsal ridge is absent. The median plate is rather large and divided longitudinally. The genital groove is bordered with chitin on each side.

These characters are taken from a pair of small specimens of the *C. punctatus* Ric. form, captured at Goondiwindi (Q.), in October 1935, and the terminalia show the genus to have quite distinctive characters, especially in the acanthophorites which are intermediate between those bearing spines and those that tend to become obsolete.

CODULA LIMBIPENNIS Macq.

Dipt. Exot., suppl. 4, 1849, 70.—*Syn.* *C. vespiformis* Thomson, *Eugenies Resa Dipt.*, 1869, 464. For further references see Hardy, *Ann. Mag. Nat. Hist.*, (10) xvi, 1934, 32–33, where *C. vespiformis* was given as unrecognized.

Originally, in 1929 (*Proc. Roy. Soc. Qd.*, xli, 61), I had sunk Thomson's *vespiformis* to synonymy in the above manner, but there were several criticisms placed before me, including one emanating from the British Museum, which seemed rather conclusive, to the effect that Ricardo, at least, had been referring to two distinct species under these names.

In my 1934 paper, I had accepted this view, but since then have given further attention to this matter, and now conclude that my critics were led astray by recorded coloration. They have given too much importance to the moustache, said to be black in Macquart's description in contradistinction to yellow in Thomson's. We have the authority, however, of Ricardo's more recent description from Macquart's type, in which it is stated to be yellow, not black. Other discrepancies in descriptions are little more than may be expected by variations, not specific differences, and therefore I have returned to my original opinion that the two authors had but one species, for there is but the one species represented in every Australian collection that I have examined, and Macquart illustrated it.

LEPTOGASTER WHITEI, new name.

Leptogaster fumipennis White, *Proc. Roy. Soc. Tasmania*, 1913, 266, and 1916, 152; Hardy, *Ann. Mag. Nat. Hist.*, (10) xvi, 1935, 166.—nec Loew 1861 (Greece).

White evidently had a complex of species from his two descriptions under *L. fumipennis*, based on the female only. As the name is preoccupied, I take this opportunity to re-name the form described by me as being White's species. There can be no doubt that White's first description can apply only to this form. White states that he has seen the male, but it is not represented in his collection at the British Museum, and there is doubt whether White correctly allied it; it might belong to some other species

he had confused under the name, in his second description. The species is quite unknown to me outside Tasmania and it does not conform to the descriptions of any other Tasmanian species.

LEPTOGASTER ANTIPODA Bigot.

Ann. Ent. Soc. France, (5) viii, 1878, 445.—*Syn.*—*vernalis* White; *autumnalis* White; and *geniculatus* White, nec Macquart, Tasmanian specimen only.

It is not difficult to recognize Bigot's species from description, as "deux bandes médianes" can apply to only one of the three species in Tasmania, and to which White's *vernalis* and *autumnalis* apply as new and old season specimens respectively. The species is variable and White erroneously placed one under the name *geniculatus* Macq. which is recorded from Tasmania but probably was from Sydney and perhaps identical with *L. bancrofti* Ric. ♀. Ricardo's *geniculatus* is probably *L. pedanius* Walker, a species that extends from Sydney to Brisbane.

The present form is known to me only from Tasmania, as also is *L. aestiva* White, the third valid species.

ADDENDUM.

In a series of papers, "Notes on Australian Muscoidea", appearing in the *Proceedings of the Royal Society of Queensland*, it is my endeavour to bring that section of the Cyclorrhapha into a phylogenetical classification, as has already been done for the lower Brachycera, and these two groups are found to interlock in colour characters in a way that has led various authors to draw attention to remarkable resemblances between them, generally with views on the subject of "mimicry". This so-called parallel development in widely different families, seems to be due to the natural sequence of colour changes which takes place with the evolutionary trends of these flies and the colour changes are not developed in any way by any action of natural selection which authors are tending to show. The resemblances between certain Diptera and Hymenoptera may also be due to the natural sequence of colour changes, and natural selection could conceivably preserve such cases but could not have brought them into existence as many authors seem to think. I do not agree with Nicholson's claim (*Aust. Zool.*, v, 1927, p. 38)* that there was first a resemblance that deceived, and natural selection played upon this bringing it to perfection (a view that researches on genes do not uphold), and substitute the idea that the resemblances may have been preserved in cases where benefit is to be derived, wherever a mimic and model are coincident in colour developments.

It is pertinent to note that, wherever the Australian lower Brachycera are regarded as mimics, they are found to be rather low in the phylogenetical tabulation.

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* Nicholson conveys this idea throughout his paper, but I quote one passage: "Before natural selection can operate in the production of a mimetic form, it is necessary that the incipient mimic should first bear a sufficient resemblance to a suitable model to be mistaken for it occasionally, and the primary resemblance must necessarily be fortuitous."

In the present discussion, coloration is not regarded as a fortuitous factor, but is considered to develop in a natural sequence, the stage reached being identical in both mimic and model, whilst natural selection is in no way concerned in development of the mimetic type thus evolved, but might possibly play a part in maintaining its stability.